White Paper

Interim Performance Report

Part 3:   Activities January 1, 2016, to June 30, 2016

Grant Number: HD-51858-14

Project Title: *The Augmented Palimpsest*: Engaging Students through AR Encounters
                              with the Past

Project Director: Tamara F. O'Callaghan

Grantee Institution: Northern Kentucky University

Date: October 7, 2016

1. **Technology Activities**

Addressing the Immediate Challenges
We continued to push Rocha, our digital artist, to deliver the 3D models in a more timely fashion. He has finally come through with several completed assets. Communication has continued to be problematic. Conference calls were not always successful since no one's cell phone would allow for more than three callers at a time, and Craig and Rocha did not want to use Skype. In the end, conference calls rotated among three speakers. Harbin also identified Trello, a web-based project management application, for use with the project. O'Callaghan and Harbin are now using Trello and are trying to encourage Craig and Rocha to use it.

Augmented Reality (AR) and Project App Development
Craig continued developing the tool with Unity 3D and Vuforia. We are still facing challenges with the audio recordings, especially in terms of synching them when a 3D model asset is triggered. However, creating shorter audio clips has helped. Testing has continued on a regular basis, but we are not yet at the point of developing the iOS version of the mobile app. The Android version needs further testing first.

3D Modeling of Assets
Rocha has delivered several assets, most notably a bollocks dagger and bollocks purse for the description of the Pardoner in *The General Prologue*. His work, although slow in coming, is very high quality. However, we have learned that such high quality modeling is not necessarily what we need for the project. More assets that are less complex would have been preferable. However, the digital artist would not "compromise" his standards in any way.

Asset: Bollocks Dagger

Asset: Bollocks Purse

2. Scholarly and Public Outreach Activities

Conferences
January 2016: "*The Augmented Palimpsest*: Engaging Students with Augmented Reality," MLA
    2016 Convention, Austin, TX (O'Callaghan and Harbin)
June 2016: "Augmented Reality Collaboration: *The Augmented Palimpsest* Project," Keystone
    DH Conference, Pittsburgh, PA (Harbin)
July 2016: "*The Augmented Palimpsest*: From Chaucer to ChaucAR." New Chaucer Society
    Congress, Queen Mary University of London, London, England, July 2016
    (O'Callaghan)

Invited Presentation
April 2016: Project Presentation to the Digital Humanities Group, Stanford University, Stanford,
    CA

Public Presentations (O'Callaghan)
March 2016: Understanding Augmented Reality (one-week module), INF 128: Principles of
    Informatics, College of Informatics, Northern Kentucky University (invited speaker)
May 2016: *The Augmented Palimpsest* Project, The English-Speaking Union of Cincinnati,
    Cincinnati Club, Cincinnati, OH (travel grant awardee presentation)

Scholarly Essays Submitted for Publication
"Virtual(ly) Medieval: Implications of the AR-Enhanced Text." *Crossing the Virtual Divide:*
    Digital Tools and Digital Divides in the Practice of Medieval Studies, eds. Matthew

Davis (North Carolina State University), Tamsyn Rose-Steel (Johns Hopkins University), and Ece Turnator (University of Texas at Austin); to be published by Amsterdam University Press.

"Augmenting Chaucer: Augmented Reality and Medieval Texts," *Digital Medieval Literature and Culture* (Routledge Literature Handbook series) to be edited by Jen Boyle (Coastal Carolina University) and Helen J. Burgess (North Carolina State University); to be published by Routledge.

Scholarly Essay to be published
Harbin, Andrea R., and Tamara F. O'Callaghan, "Text and the Sensorium: *The Augmented Palimpsest* as an Augmented Reality Text," *The Digital Arts and Humanities*, eds. Charles Travis and Alexander von Lunen (Springer International Press).

3. Other Activities

Harbin completed all the needed the print pages with detailed manuscript borders with identified fiducial markers. O'Callaghan and Harbin spent considerable time testing the various versions of the project's mobile app with Android smart devices.

They revised their essay "Text and the Sensorium: *The Augmented Palimpsest* as an Augmented Reality Text" for the essay collection *The Digital Arts and Humanities*. They also drafted two other scholarly essays: "Virtual(ly) Medieval: Implications of the AR-Enhanced Text," for *Crossing the Virtual Divide: Digital Tools and Digital Divides in the Practice of Medieval Studies*, and "Augmenting Chaucer: Augmented Reality and Medieval Texts," for *Digital Medieval Literature and Culture* (Routledge Literature Handbook series). Both peer-reviewed essays are invited contributions, the result of our growing reputation in the field of AR and the digital humanities.

During the spring and summer of 2016, O'Callaghan and Harbin had a number of opportunities to present on the project at a variety of venues. Most significantly, the oral presentation at the MLA Convention in January resulted in one of the attendees, Michael Widner (Stanford University), inviting O'Callaghan and Harbin to present *The Augmented Palimpsest* project to the Digital Humanities Group at Stanford University in April.

O'Callaghan was invited to design and lead a module on AR for INF 128: Principles of Informatics, a General Education course offered by the College of Informatics at Northern Kentucky University. The module required O'Callaghan to give a one-hour interactive presentation on AR and *The Augmented Palimpsest* Project to 100 undergraduate students and lead an AR-related activity with the students later that same week.

AR Presentation to INF 128 Students at NKU
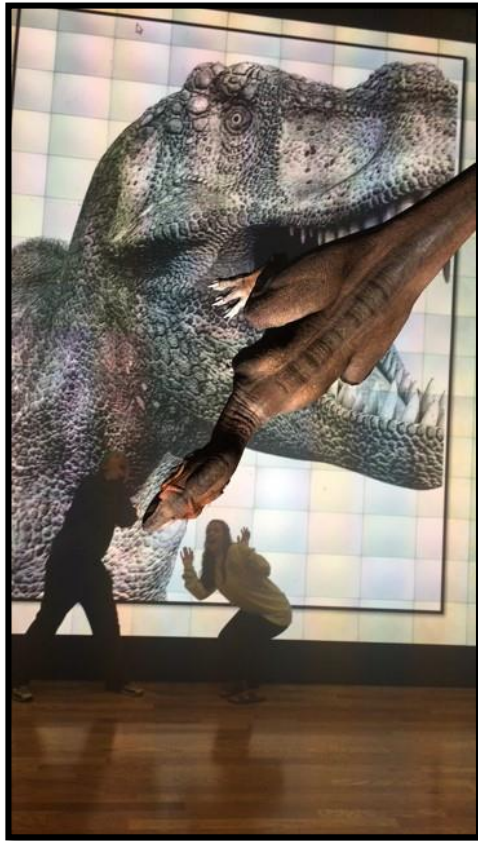
Students playing with AR T-Rex projected on Digitorium screen

Because of restricted travel funds, O'Callaghan and Harbin made the decision to split their conference presentation obligations in order to reduce travel costs. As a result, Harbin gave a presentation on the project at the annual 2016 Keystone DH Conference in Pittsburgh in June. The session included three presentations on AR, so Harbin was able to network with other humanists using the technology. O'Callaghan gave the poster presentation at the New Chaucer Society Congress in London, England, in June. She was partially funded by the English-Speaking Union of Cincinnati, which awarded her a travel grant based on the project. She gave a presentation to the members of the English-Speaking Union as an awardee.

The poster presentation at the New Chaucer Society Congress was very successful. The New Chaucer Society is the leading international learned society for studies on the works of Geoffrey

Chaucer. Ruth Evans (St. Louis University), the Executive Director of the organization, saw the poster and had asked to include *The Augmented Palimpsest* Project as one of the resources for the "Teaching Chaucer in the High Schools" website that the New Chaucer Society is currently creating. There were also high school English teachers attending the Congress as part of the organization's outreach to high schools. Several of the teachers have asked to test the project with their students in the classroom.

In addition, O'Callaghan and Harbin have been asked to include the project as part of the Global Middle Ages Project (GMAP) <http://globalmiddleages.org/>, a DH project by an international collaboration of scholars to see the world whole, c. 500 to 1500 CE, to deliver the stories of lives, objects, and actions in dynamic relationship and change across deep time.

Most recently, O'Callaghan and Harbin have been invited to oversee a special edition on AR and medieval studies for the peer-reviewed online journal *Accessus: A Journal of Premodern Literature and New Media* <http://scholarworks.wmich.edu/accessus/>. We plan to do so in 2017.

4. Challenges

The major challenges faced by the project directors, O'Callaghan and Harbin, were as follows:

- Overcommitment to invitations for scholarly essays: In 2015, O'Callaghan and Harbin responded successfully to a CFP for essays on new technologies in the humanities and received two invitations to contribute essays to collections on the digital humanities in medieval studies. Although delighted to have all three opportunities to publish on the project and AR technology, O'Callaghan and Harbin did not expect the deadlines to coincide as closely as they did to each other and to conference obligations. All deadlines were met, but the process was very stressful at times. Better planning was needed.
- Lack of travel funds: Institutional funding for travel has become extremely limited for both O'Callaghan and Harbin so it has been difficult to disseminate the project at conferences. Dividing the conference obligations so that only one project director attended a conference in the summer of 2016 did help. However, the project directors are restricting travel for the immediate future—a disappointment because it means that neither O'Callaghan nor Harbin have been able (or will be able) to attend the Augmented World Expo (AWE) held annually in California. The AWE is the world's largest industry conference on AR, VR, and wearable computing, an event that would greatly benefit the project directors and the project itself.
- Project management: Managing the team, especially the digital artist, has been very challenging. Effective communication among talented people from different disciplines is not an easy process, and using project management technology does not work if all members of the team will not commit to using the technology. Even though team members may agree that conference calls and/or project management software are the best approach, they do not necessarily agree on the kind of technology to be used. The project directors have learned that, in the future, they must have team members agree to use specific technology, such as Skype or Trello, *before* the project starts.

- Selection of digital artist: As the previous reports have indicated, working with our digital artist has been challenging. He was chosen based on his portfolio, a strong recommendation from the AR expert on the project, and his fee ($20 per hour). The project directors have learned that they should have gone with a digital artist with more experience working on team projects, even if that artist had cost more ($50 per hour). A more experienced artist would have understood that meeting deadlines was more important than creating the highest quality 3D models.
- Cloud storage of project files: The files for 3D model assets and the mobile app are so large that Dropbox could not be used for cloud storage. We now have a GitHub account and are building a site for the project materials.

Appendices

1. Poster presentation (screenshot) for 2016 New Chaucer Society Congress
2. Project presentation at Stanford University (poster advertising the talk)
3. Essay submission for *Crossing the Virtual Divide: Digital Tools and Digital Divides in the Practice of Medieval Studies*
4. Essay submission for *Digital Medieval Literature and Culture* (Routledge Literature Handbook series)

The Pages for *The Canterbury Tales* with fiducial markers identified in their medieval manuscript borders were to be included in the Appendices, but they make the document file too big to upload. They can be made available upon request.

Project Presentation at Stanford University (Poster)
April 2016

Tamara F. O'Callaghan

Andrea R. Harbin

(with Alan B. Craig and Ryan W. Rocha)

Virtual(ly) Medieval: Implications of the Virtual and the Augmented[1]

In Fitt II of the anonymous fourteenth-century Middle English poem *Sir Gawain and the Green Knight*, Gawain finds himself lost in a snowy forest as he searches for the Green Chapel. In desperation, he prays to the Virgin Mary for "sum herber [some harborage]"[2] where he might hear Mass before continuing his quest for the chapel and the Green Knight. No sooner has Gawain finished his prayer, when a marvelous castle suddenly appears before his eyes:

> A castel þe comlokest þat euer knyȝt aȝte,
>
> Pyched on a prayere, a park al aboute,
>
> With a pyked palays pyned ful þik,
>
> Þat vmbeteȝe mony tre mo þen two myle.
>
> Þat holde on þat on side þe haþel auysed,
>
> As hit schemered and schon þurȝ þe schyre okeȝ. (lines 767-72)
>
> [A castle the comeliest that ever knight commanded,

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[2] *Sir Gawain and the Green Knight*, trans. Larry D. Benson, ed. Daniel Donoghue (Morgantown: West Virginia UP, 2012), line 755.

Placed on an open meadow, a park all around,

With a spiked palisade penned in full thick,

That enclosed many trees more than two miles.

That hold on that one side the horseman observed,

As it shimmered and shone through sheltering oaks.]

Materializing in the forest from seemingly out of nowhere, Bertilack's castle – Hautdesert – with its glistening turrets, vast parkland, and double moat has an otherworldliness about it. It not only appears magically, as if in answer to Gawain's prayers, but its inhabitants prove to be magical too. Despite its superficial resemblance to Camelot in terms of physical appearance, the castle is an alternate world: one that differs significantly from King Arthur's court, particularly in terms of its values. Once Gawain enters the castle and accepts Bertilack's hospitality, he leaves his reality (namely the court of Camelot) behind and enters a world not defined so much by good and evil, but rather by the success of its performativity. Just how well does Bertilack's castle work or operate for Gawain and, by extension, for the reader? Very well as it turns out.

By the end of the poem, the twenty-first century reader will likely realize that, when Gawain rode across the great drawbridge and through the broad gate of Hautdesert in Fitt II (lines 817-21), the knight entered an alternative world, one that has much in common with our present-day understanding of virtual reality. Virtual reality (VR) may be defined as "a medium composed of interactive computer simulations that sense the participant's position and actions and replace or augment the feedback to one or more senses, giving the feeling of being mentally

immersed in the simulation (a virtual world)."[3] Obviously, Hautdesert is not a computer-generated simulation, but it does meet the four key elements of VR: it is a *virtual* space for the participant (Gawain); it is *immersive* on both a physical and mental level for the participant; it provides *sensory feedback* directly to the participant; and it is *interactive*, responding to the participant's actions.[4] The purpose in making this connection between the episode in *Sir Gawain and the Green Knight* and our understanding of VR is not to argue that the poem somehow anticipates the development of the medium, but rather to suggest that Hautdesert, as an alternate reality, demonstrates the current anxiety with the computer virtualization in general and VR in particular. Hautdesert is not real; it is merely a semblance of Camelot. Bertilack is not King Arthur, and his lady is not Guinevere. Gawain's mistake (and, by extension, the reader's too) is to assume that these two parallel worlds are the same, that Bertilack's castle functions exactly as Arthur's court does. Consequently, Gawain does not recognize that he is being tested and even tricked by the castle's inhabitants because the environment seems so familiar and authentic.

Virtual constructions of historical objects and architecture raise similar concerns. To what extent are these 3D models accurate representations of the original? In many ways, both the castle of Hautdesert in *Sir Gawain and the Green Knight* and VR serve to validate Jean Baudrillard's understanding of simulacra and concerns about the hyperreal. In *Simulacra and Simulation*, Baudrillard argues that there are three orders of simulacra: the first, associated with the early modern period, in which the image is clearly a counterfeit of the real; the second,

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[3] William R. Sherman and Alan B. Craig, *Understanding Virtual Reality: Interface, Application, and Design*, The Morgan Kaufmann Series in Computer Graphics (San Francisco: Morgan Kaufmann Publishing, 2003), 13.

[4] Sherman, 6-11; for further discussion of these key elements, see Johnny Hartz Søraker, "Virtual Entities, Environments, Worlds and Reality: Suggested Definitions and Taxonomy," *Trust and Virtual Worlds: Contemporary Perspectives*, eds. Charles Ess and May Thorseth (New York: Peter Lang Publishing, 2011), 44-72.

associated with the industrial age, in which the real is so closely represented by the image that it threatens to replace the real; and the third, associated with our postmodern period, in which the image precedes the real and thus determines it.[5] This loss of distinction between reality and its representation in the third order of simulacrum results in the hyperreal—a world "without origin or reality."[6] It is pure simulation and, as a result, creates an anxiety of origin and authenticity. Even though *Sir Gawain and the Green Knight*, as a poem written in the Middle Ages, should fall under the first order of simulacrum, the fact that Gawain cannot recognize Hautdesert as an alternate, or counterfeit, representation of Camelot indicates that Bertilack's castle is, for him (at least while he resides there for three days), a hyperreality. Its falseness is only revealed to Gawain (and the reader) after he has departed and finally found the Green Knight at the Green Chapel.

Virtual worlds, including those associated with VR, can evoke an apprehension about the hyperreal, especially if the 3D model is used to substitute for the original. The current interest by computer graphic experts and enthusiasts in the creation and redistribution of virtual historic sites illustrates the problem. "Archaeological illustration and reconstruction is not new," as Clifford L. Ogleby notes, "but the advent of high-speed affordable computers and the associated graphics capability gives people the opportunity to create better looking imagery. The imagery, however, is often the result of the technology, not archaeological or historical research. When this imagery is distributed without the accompanying research that explains the decisions made in the reconstruction, it is open to a variety [of] interpretations. This problem is compounded when the imagery is posted on the WWW, as the image can be extracted from the surrounding

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[5] Jean Baudrillard, *Simulacra and Simulation*, trans. Sheila Faria Glaser (Ann Arbor: University of Michigan Press, 1994), 1-7.
[6] Baudrillard, 1.

text and interpreted as an artifact rather than as a diagram." [7] Ogleby demonstrates this issue

using easily obtainable images from the web that purport to portray accurate reconstructions

(some computer generated) of the mausoleum at the ancient Greek city of Halicarnassus. The

images are imprecise and even erroneous, yet accepted by the general public as real: "many

people will tend to 'see' a photo-like image to be more like a photograph, and therefore a record

of a real place in time."[8] Not surprisingly, these online images almost always fail to include

providence, authorship, and veracity—information that would help the viewer to determine the

authenticity of each 3D model and would serve as a reminder that the image being viewed is just

that, an image, and not the original. The problem is only exacerbated when these models are

incorporated into a virtual environment such as Google Earth or Second Life.[9] These immersive

and interactive worlds encourage the user to accept the computer-generated model as a realistic

substitution for the original. The user does not simply view the 3D model unguided, but in the

case of Second Life, may even take on a virtual identity in the form of an avatar that allows the

user to cross the threshold of the screen to explore this enticing virtual world.

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[7] Clifford L. Ogleby, "The 'Truthlikeness' of Virtual Reality Reconstructions of Architectural Heritage: Concepts L and Metadata," *3D-ARCH 2007: 3D Virtual Reconstruction and Visualization of Complex Architectures*, International Society for Photogrammetry and Remote Sensing (ISPRS), 36.5 (2007), Web, 10 Feb. 2016 http://www.cyi.ac.cy/system/files/ogleby.pdf
[8] Ogleby.
[9] Ogleby; Maria Rousso expresses a similar concerns about virtual heritage representation: "First, the issue of validity of information, commonly referred as authenticity. Second, the importance of accuracy in the representation of this information. Authenticity and accuracy are characteristics that archeologists, historians, and museum people strive to achieve and that the general public comes to expect from them. On the other hand, technologists dealing with the visualization of certain content are more concerned with the technical issues that pertain to implementation of the visualization and less concerned with authenticity and accuracy of the content itself" ["Virtual Heritage: From the Research Lab to the Broad Public," *Virtual Archaeology: Proceedings of the VAST Euroconference*, ed. Franco Niccolucci (BAR International Series 1075, 2002), 93.]

Although Baudrillard's concerns about the hyperreal should be kept in mind as we move (and sometimes lurch) forward into the virtual, that anxiety should not dissuade us from using the technology for scholarly, pedagogical, and even community outreach purposes. Pierre Lévy argues convincingly against viewing the virtual as simply unreal: "The virtual, strictly defined, has little relationship to that which is false, illusory, or imaginary. The virtual is by no means the opposite of the real. On the contrary, it is a fecund and powerful mode of being that expands the process of creation, opens up the future, injects a core of meaning beneath the platitude of immediate physical presence."[10] It is an actualization rather than a realization, one that involves "the production of new qualities, a transformation of ideas, a true becoming which nourishes the virtual in a feedback process."[11] Although we may accept that the virtual and the real are not binary opposites, it is important to recognize that they exist on a continuum that supports a complete range of realness from the fully real to the fully virtual. Such a reality-virtuality continuum was first proposed by Paul Milgram and his colleagues. They suggest that everything in between is a mixture of reality and virtuality, including augmented reality (AR) in which the real world is augmented by virtual enhancements and augmented virtuality (AV) in which the virtual world is augmented by the real.[12]

Certainly, humanity has long held a fascination in trying to create a virtual experience of reality. In the nineteenth and early twentieth centuries, panoramic paintings became particularly

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[10] Pierre Lévy, *Becoming Virtual: Reality In The Digital Age*, trans. Robert Bononno (New York: Plenum Press, 1998): 16.

[11] Lévy, 15; for a fuller analysis of Lévy's understanding of actualization, see Marie-Laure Ryan, "Cyberspace, Virtuality, and the Text," *Cyberspace Textuality: Computer Technology and Literary Theory*, ed. Marie-Laure Ryan (Bloomington: Indiana University Press, 1999), 78-107.

[12] Paul Milgram et al., "Augmented Reality: A Class of Displays on the Reality-Virtuality Continuum," *Proceedings of the SPIE Conference on Telemanipulator and Telepresent Technologies* 2351 (1995): 282-92; for a detailed analysis of Milgram's concept, see Alan B. Craig, *Understanding Augmented Reality: Concepts and Applications* (Waltham, MA: Elsevier, 2013), 28-35.

popular, including the development of 360-degree murals that were intended to fill the entire field of vision and make the viewer feel as if he or she were in the virtual world depicted by the paintings.[13] The nineteenth-century also saw the development of the stereoscopic viewer and images, precursors to the View-Master and, more recently, Google Cardboard.[14] Experimentation in film also contributed to the development of the technology, particularly the widescreen camera lens. French filmmaker Abel Gance introduced "polyvision," a specialized widescreen film format that involved the simultaneous projection of three reels of film in a lateral montage, in his 1927 silent epic *Napoléon*.[15] Polyvision, as well as the later development of CinemaScope and Panavision using widescreen lenses, gave the audience a panoramic and, subsequently, more immersive film experience. In 1929, the flight simulator was developed,[16] making it the first significant virtual environment that was not for entertainment purposes.

The technology finally went beyond just sight and sound with the creation of "Sensorama" by cinematographer Morton Heilig in the 1950s. Sensorama was a multimodal film experience that engaged all five senses with its "stereo speakers, a stereoscopic 3D display, fans, smell generators and a vibrating chair," although its development ceased because the device was ultimately never sufficiently funded .[17] Heilig also invented the first VR head-mounted display, a

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[13] Seth Thompson, "VR Panoramic Photography and Hypermedia: Drawing from the Panorama's Past," *ISEA 2015: Proceedings from the 2015 International Symposium on Electronic Art*, 2015, Web, 04 Feb. 2016 http://isea2015.org/proceeding/submissions/ISEA2015_submission_46.pdf; for an example of a 360-degree mural, see the Mural Room of the Santa Barbara County Courthouse which depicts the history of Santa Barbara, California, painted by Daniel Sayre Groesbeck in the early twentieth century: https://www.billheller.com/vr/Santa-Barbara-County-Courthouse-Mural-Room-360/
[14] Virtual Reality Society, "The History of Virtual Reality," *Virtual Reality Society*, 2016, Web, 04 Feb. 2016 http://www.vrs.org.uk/virtual-reality/history.html
[15] Paul Cuff, *A Revolution for the Screen: Abel Gance's Napoleon*, Film Culture in Transition (Amsterdam: Amsterdam University Press, 2015), 24.
[16] Virtual Reality Society.
[17] Virtual Reality Society.

device that was much more fully developed by Ivan Sutherland, a computer scientist widely considered to be the "father of computer graphics."[18] However, it was Jaron Lanier, a computer scientist/philosopher and founder of VPL Research, Inc., who popularized the term "virtual reality" in 1987 to describe the field.[19] It is at this point that we see a substantial increase in the number of intentional and thoughtful explorations of human-computer interaction with the appearance of films, such as *Tron* (1982), *The Lawnmower Man* (1992), and *The Matrix* (1992), and the debut of the holodeck in the television series *Star Trek* (1987). Game headsets appear in the 1990s, and the CAVE (Cave Automatic Virtual Environment), an immersive video theater experience in which a user wearing stereoscopic glasses views images in 3D as they are projected on the walls of a contained space, develops.[20]

In terms of medieval virtual worlds, we need only look to digital gaming to understand some of the challenges when visualizing historic periods such as the Middle Ages with technology. For example, the 3D medieval fantasy MMORPG (massively multiplayer online role-playing game) *Dark Age of Camelot* had a storyline based on Arthurian legend. The VR medium of such interactive gaming makes the experience highly immersive and interactive for the player, enhanced by the fact *Dark Age of Camelot* supported both Player vs. Player and Realm vs. Realm combat (the latter of which the game pioneered on a large scale). Released in 2001 by Mythic Entertainment, *Dark Age of Camelot* was set ten years after the death of Arthur and presented a narrative in which Norse and Celtic forces vied for power in Albion, the realm of King Arthur. Such a re-visioning of the legend is certainly not new to Arthurian literature; modified and even entirely new narratives of Arthur's story have always been popular, even

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[18] Virtual Reality Society.

[19] Jonathan Steuer, "Defining Virtual Reality: Dimensions Determining Telepresence," *Journal of Communication* 42.4 (1992): 73-74.

[20] Virtual Reality Society.

during the Middle Ages. Not surprisingly, the high-quality graphics in *Dark Age of Camelot* demonstrate a similar reinterpretation of the medieval setting. Figure 1 shows a stylized castle in the realm of Albion, where the remainder of Arthur's court resides. The 3D architecture has the "flavor" of the Middle Ages but not its authenticity. The lack of historic accuracy is not surprising in a fantasy-based digital game. The primary purpose is entertainment, not historic re-creation or educational value.

Figure 1 – Castle in the realm of Albion, *Dark Age of Camelot*

Similarly, the NPC (non-playing character) of the Green Knight (Figure 2) does not resemble the literary character found in *Sir Gawain and the Green Knight*. Although described in his game profile as a "giant," this Green Knight appears similar in size to the avatars playing in the virtual world. He is not fully green in appearance; only his cloak, gloves, and boots are green. He is also dressed in armor, something the Green Knight of the Middle English poem explicitly does not wear (lines 151-223). Instead, what we see in the 3D model of this NPC is an enthusiasm on the part of the game developers for the period and even for the medieval poem based largely on popular culture and their own imaginations (and, perhaps, even on their own experience reading the poem in the classroom) of what a medieval world would look like.

Figure 2 – Green Knight from *Dark Age of Camelot*

Supporting Olgeby's observations about the challenges of historical accuracy in virtual worlds,

the developers of *Dark Age of Camelot* failed to construct a 3D game environment with

reasonable verisimilitude. Obviously, its intended audience did not hold such an expectation

since the experience of a fantasy medieval 3D world, not an historically accurate re-creation of

the Middle Ages, was the appeal of the MMORPG. Nevertheless, the virtual environment of the

digital game exemplifies the concerns faced by experts building virtual heritage sites. For

historians, archaeologists, and other scholars, the photorealism of the 3D models is the primary

goal. In general, there are ten principles of 3D photorealism: clutter and chaos; personality and

expectations; believability; surface texture; specularity; aging dirt, rust, and rot; flaws, tears, and

cracks; rounded edges; object material depth; and radiosity (light reflections off diffused

surfaces).[21] To achieve photorealism, the computer-generated object should demonstrate at least

seven of these ten principles.[22] The virtual world should not be pristine and unblemished because

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[21] Bill Fleming, *3D Photorealism Toolkit* (New York: John Wiley & Sons, 1998), 3.
[22] Fleming, 3-4.

reality is messy and dirty. Simply stated, the gaming environment of *Dark Age of Camelot* is just too clean.

In contrast to digital games, more recent attempts by scholars to create virtual heritage sites, some specifically set in the Middle Ages, demonstrate the effectiveness of photorealism when it is done well and with intention. [23] *Bologna 3D Open Repository* <http://dati.comune.bologna.it/3d> is the result of a collaborative project between the municipality of the city of Bologna and CINECA Interuniversity Consortium, an academic supercomputing group that offers technological support to education, business, and the community. The project's primary goal was to build 3D models for the creation of a virtual Bologna that the municipality could use to promote the candidacy of the city's historic porticoes, or arcades, as a UNESCO World Heritage Site. Figures 3 through 7 show some of the 3D models created by the consortium:

Figure 3 – Portico of San Luca

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[23] We are making a distinction here between virtual heritage sites, which are 3D reconstructions of archaeological sites, architecture, or any other type of object, and 3D "real virtual worlds," which combine 3D with "community, creation, and commerce," such as World of Warcraft and Second Life; see Yesha Sivan, "3D3C Real Virtual Worlds Defined: The Immense Potential of Merging 3D, Community, Creation, and Commerce," *Journal of Virtual Worlds Research* 1.1 (2008): 1-32.

Figure 4 – City towers

Figure 5 – Hilly landscape south of the city

Figure 6 – Characters in medieval clothing

Figure 7 – Scene of a medieval university lecture

The computer graphics are high quality and demonstrate a number of the principles of digital photorealism. In particular, the architecture and landscapes exhibit great attention to detail and authenticity. The human figures, however, are generally caricatures rather than realistic representations of people. Such a use of humor in a virtual historic re-creation emphasizes the project's need to appeal to a broad, public audience. The team members also worked with the community, offering training to students and other interested citizens in 3D modeling using such accessible computer graphic software a Blender.[24] The project team has, in fact, used the 3D models to produce an award-winning stereoscopic short film, *APA Etruscan* (2012), for the Museum of the History of Bologna in which APA, an Etruscan

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[24] Antonella Guidazzoli, Maria Chiara Liguori, and Mauro Felicori, "Open Creative Framework for a Smart Cultural City: Bologna Porticoes and the Involvement of Citizens for a UNESCO Candidacy," *Information Technologies for Performing Arts, Media Access, and Entertainment Lecture Notes in Computer Science*, Vol. 7990, 2013, 58-65; the 3D models at the online repository are also freely available to use for educational/non-profit purposes.

character (see Figure 7), takes the viewer through a virtual history of the city.[25] However, the virtual world created by the project team is not truly VR since there is no interactivity for the viewer and thus the immersive experience is limited for the viewer.

3D Paris Saga <http://paris.3ds.com/> is a different story, not just in the way it tells the narrative of the history of Paris but also in its use of computer visualization, VR, and AR to do so. Dassault Systèmes, a European software company that specializes in 3D design, built a complex virtual world that traces the history of the city through almost 2,000 years. In the process, they not only visualized well-known architecture and monuments in 3D, but also revived public buildings lost or significantly changed over time. The project was introduced in three stages. The first was an immersive, interactive event in Paris hosted by Dassault for the launching of the project. This event invited the general public to explore *3D Paris Saga* for themselves in a CAVE using 3D glasses. Dassualt still has the CAVE constructed at its offices located outside of Paris and allows visitors to experience the *3D Paris Saga* there on occasion.[26] A 90-minute documentary that provided a comprehensive history of Paris was then shown on French television in October 2012. The documentary used the virtual sites created for *3D Paris Saga* to recreate Paris from the Gallo-Roman period to the nineteenth century. A four-part documentary, *Paris, A Capital Story*, followed on French television that same month. It explored the historic periods and the city in greater detail and also used the virtual Paris of the *3D Paris Saga* to illustrate the construction of historic monuments. The project itself takes the form of an interactive 3D website that, unfortunately, remains only PC compatible, a mobile app for the

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[25] The full version is available at the museum, but the first three minutes can be seen here: https://www.youtube.com/watch?v=JGRt63dcJsg

[26] Vitali Vitaliev, "AR and 3D in Travel and History Applications, " *Engineering and Technology Magazine* 8.4 (2013), Web http://eandt.theiet.org/magazine/2013/04/secret-window.cfm

iPad, and an AR-enhanced print book.[27] The goal of Dassault was to preserve the architectural heritage of Paris by resurrecting vanished and damaged architecture in 3D to its former glory and to give the public an educational experience that was enhanced by the virtual, VR, and AR.

Dassault's video of their 3D Parisian world <https://www.youtube.com/watch?v=-64kHmCJGMA> takes the viewer on a tour of the city through the ages. The visual accuracy and detail of the 3D architecture, topography, and atmosphere enhance the photorealism of the virtual world. The fact that familiar monuments are shown in various stages of construction transforms the virtual experience into a deeper educational one. Unlike in a digital game, the 3D human models are merely shadowy figures. They remind the viewer that Paris was always inhabited; however, because the figures are so ethereal, they encourage the viewer to explore the historic constructions rather than interact with the animated models as in a game environment. Considerable attention is also given to the appearance of the skies, reflecting typical Parisian weather rather than an idealized and eternal perfect sunny day. In 2014, Dassault partnered with the Centre des Monument Nationaux to expand the *3D Paris Saga* with the creation of a 3D reconstruction and interactive experience of the fourteenth-century Palais de la Cité and the Sainte-Chapelle (see Figures 8 through 10):

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[27] Dassault Systèmes, "Paris the Great Saga – Dassault Systèmes tells a fascinating transmedia story: the story of Paris," *EXALEAD Blog*, 28 Sep. 2012, Web http://blog.exalead.com/2012/09/28/paris-the-great-saga-dassault-systemes-tells-a-fascinating-transmedia-story-the-history-of-paris/
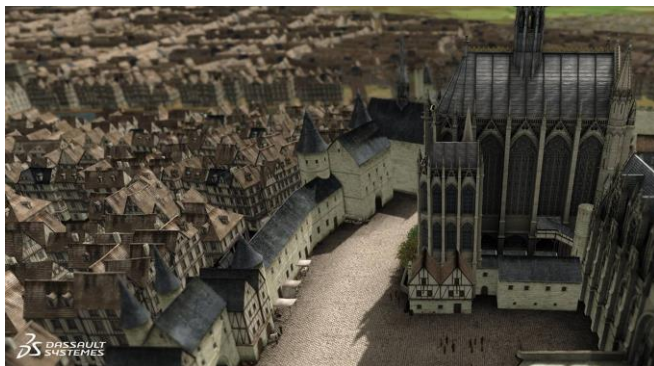
Figure 8 – View of the Grande Cour and Trésor de Chartres (Dassault Systèmes)

Figure 9 – View of the rose window on the west façade (Dassault Systèmes)

Figure 10 – View over the king's garden from Salle de la Pointe (Dassault Systèmes)

The project celebrated the renovation of the Sainte-Chapelle and the 800th anniversary of the birth of Louis IX. Using the expertise of Dany Sandron, University Professor of Art and Archaeology (Université Paris-Sorbonne), and a laser scan of the architectural structure, the project team made over the newly restored building in 3D.[28] In addition to adding the 3D model to the interactive website for the *3D Paris Saga*, Dassault installed an interactive kiosk in the lower chapel of the Sainte-Chapelle, allowing visitors to enjoy an immersive and educational virtual experience *in situ*.[29]

VR, in its most effective form, requires the user to be outfitted by some sort of head-mounted display, such Oculus Rift, in order to suppress a conscious awareness of the real world. Consequently, the experience must be held in a static, controlled space, such as a CAVE; otherwise, the user will collide with real-world objects in the effort to participate fully in the virtual world. For many individuals, the VR experience results in motion sickness, sometimes known as VR sickness or cybersickness.[30] In contrast, AR is much more accessible because the required equipment is minimal. The fact the user remains cognizant of the real world around him or her while using the technology eliminates the possibility of motion sickness. Perhaps then it is no surprise that the most successful component of the *3D Paris Saga* has been the AR-enhanced companion print book published by Flammarion. AR is a medium in which digital information is overlaid on the physical world that is in both spatial and temporal registration with the physical

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[28] "Voici à quoi ressemblait le Sainte-Chapelle au 14e siècle," *Sciences et Avenir*, 25 Jun. 2015, Web, 20 May 2016 http://www.sciencesetavenir.fr/voyage/20150622.OBS1313/voici-a-quoi-ressemblait-la-sainte-chapelle-au-14eme-siecle.html

[29] Dassault's video of 3D visualization of the Palais Royal and the Sainte-Chapelle in 14th-century Paris may be found here: https://www.youtube.com/watch?v=akD_nAvD_co

[30] Such motion sickness may be caused by display and technology issues, sensory conflict, or postural instability; see Joseph L. LaViola, Jr., "A Discussion of Cybersickness in Virtual Environments," *SIGCHI Bulletin* 32.1 (2000): 47-56.

world and that is interactive in real time.[31] Most AR technology uses a mobile application on a smart device to trigger the digital enhancements embedded in the printed page. Dassault, however, requires the user to hold select pages from the print volume up to the web camera on a PC.[32] Like a virtual pop-up book, the 3D models appear on the on the page as viewed through the computer screen:

Figure 11:   AR-enhanced print text (Dassault Systèmes)

The user may turn the book in order to see all sides of the 3D model, thereby gaining a greater appreciation of Parisian architecture throughout history. AR-enhanced texts are not new. Mark Billinghurst and his team at the Human Interface Technology (HIT) Lab, University of Canterbury, New Zealand, created some of the first examples in the early 2000s. Called "magicbooks," the texts are designed to encourage children to read:

> The computer interface has become invisible and the user can interact with
> graphical content as easily as reading a book. This is because the MagicBook
> interface metaphors are consistent with the form of the physical objects used.

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[31] Craig, 36.

[32] For an example of the book works, please see the following video:
https://www.youtube.com/watch?v=sbZuQcXchkM

Turning a book page to change virtual scenes is as natural as rotating the page to see a different side of the virtual models. Holding up the AR display to the face to see an enhanced view is similar to using reading glasses or a magnifying lens. Rather than using a mouse and keyboard based interface users manipulate virtual models using real physical objects and natural motions. Although the graphical content is not real, it looks and behaves like a real object, increasing ease of use.[33]

Although early forms of AR used the QR (quick response) code to trigger enhancements, the technology has advanced to the point that any complex, pigmentally dense image may be turned into a fiducial marker,

A different AR project, *The Augmented Palimpsest* demonstrates the effectiveness of AR for teaching students to read and appreciate Middle English literature.[34] Using *The General Prologue* from Geoffrey Chaucer's fourteenth-century poem, *The Canterbury Tales*, the mobile application delivers digital enhancements that emerge from the printed page when a smart device is held over the appropriate fiducial marker. These enhancements provide the reader with linguistic, historical, and cultural contexts, thus giving students greater access to medieval material culture and history. The digital content includes 3D models of medieval artifacts and architecture, complex enough to be viewed from multiple angles. Because the enhancements emerge from the printed page, the mobile application will maintain a pedagogical emphasis on close reading while encouraging students to develop their skills in textual analysis, critical thinking, interdisciplinary study, and new media literacy. It ultimately improves the reader's

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[33] Mark Billinghurst, Hirokazu Kato, and Ivan Poupyrev, "The MagicBook: A Transitional AR Interface," *Computers & Graphics* 25.5 (2001): 747.

[34] Team members include the project co-directors, Tamara F. O'Callaghan and Andrea R. Harbin, as well as Alan B. Craig, Ph.D., independent research scientist and Digital Humanities Specialist for the Extreme Science and Engineering Discovery Environment (XSEDE) project, and Ryan W. Rocha, BFA, independent digital artist.

comprehension of the text by preserving the physical and kinesthetic connection to the text. The highly detailed medieval manuscript border that surrounds the text has the complexity needed to create fiducial markers from the unique patterns (see Figure 12).
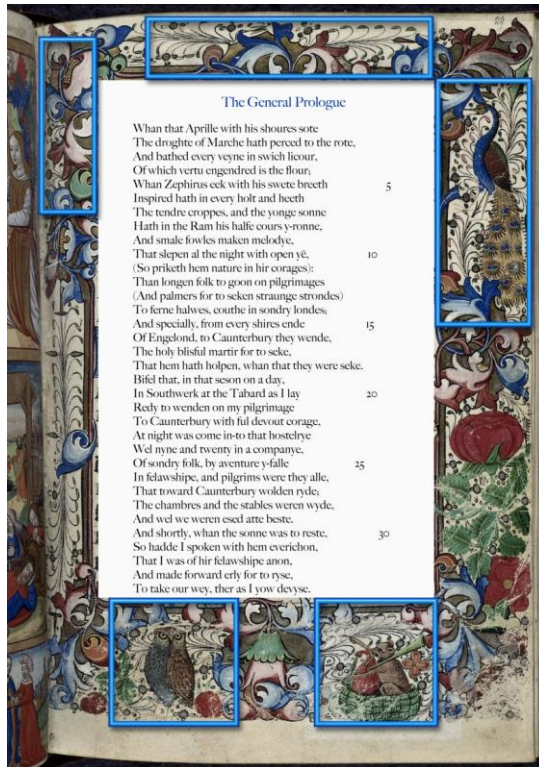
Figure 12: AR-enhanced page with opening of Chaucer's *General Prologue*; manuscript border from British Library, Harley MS 2887, f. 29r

Each blocked off pattern from the border triggers a different enhancement, including but not limited to audio, video, images, and interactive maps.[35] Fiducials, such as the peacock in Figure 13, can also launch a 3D model from the printed page.

Figure 13: Manuscript border detail from
British Library, Harley MS 2887, f. 29r

This particular fiducial triggers a 3D model of Canterbury Cathedral (see Figure 14). The user can remove the roof and explore inside simply by holding the smart device over the peacock and covering the bird's tail with the user's fingers, creating a virtual "button" on the printed page.

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[35] Martin K. Foys argues that the mappamundi, as a visualization of the medieval world, is a form of VR; see *Virtually Anglo-Saxon: Old Media, New Media, and Early Medieval Studies in the Late Age of Print* (Gainesville: University Press of Florida, 2007), 110-58.
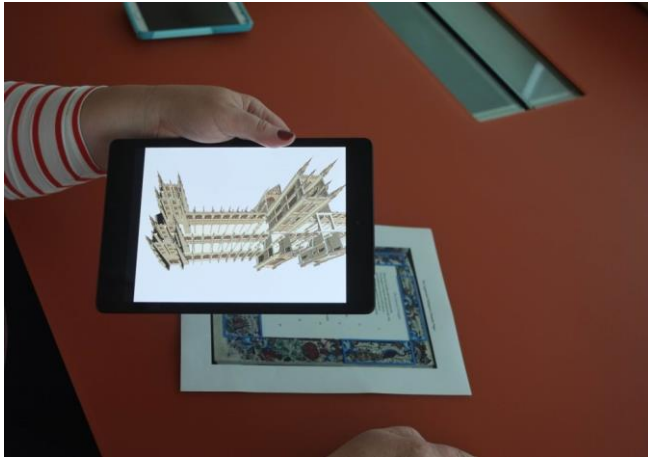
Figure 14: 3D Canterbury Cathedral (photo courtesy of Steven Weiss)

This virtual button is a significant advancement on the more typical tapping on the screen of the smart device. As such, the project is able to anticipate further technological advances in AR, including the replacement of smart devices with glasses or even contact lenses. In addition, AR allows for the primary focus to remain on the printed text of the poem. Unlike VR, the user cannot get lost wandering the virtual world without direction on his or her own. Instructors need simply tell students to put down the smart device and they will return to a close reading of the text without distractions.

The emphasis on historical authenticity and photorealism for 3D virtual worlds and VR also applies to AR. Students will gain no long term understanding of the historical and cultural contexts in relation to Chaucer's poem if the 3D models are not accurate and meaningful. Rather than a stylized dagger and bag, Figures 15 and 16 depict the bollocks dagger and testicular purse that the Pardoner could easily have brought on the pilgrimage to Canterbury Cathedral.

Figure 15: Bollocks dagger (Ryan W. Rocha, digital artist)

Figure 16: Testicular purse (Ryan W. Rocha, digital artist)

Both 3D models are historically faithful.

The question of historical accuracy can, however, be raised about the use of different medieval manuscript borders to surround the text of Chaucer's poem. None of the borders are

from manuscripts of *The Canterbury Tales*. One reason for this switch is the fact that the real borders that surround the folia of the poem in the two most important manuscripts, the Hengwrt manuscript and the Ellesmere manuscript, are not sufficiently complex or varied to serve as triggers for the digital enhancements. Another reason is to provide students with more exposure to medieval manuscripts as material culture. Each border chosen to surround that printed page of the AR-enhanced text comes from a manuscript and/or depicts images in the border that relate to the passage of the poem on the page.[36] One fiducial on each page will take students to Chaucer's original text in the digitized Ellesmere manuscript available at the Huntington Library website; a second fiducial will take students to the appropriate digitized manuscript at the British Library. This border in Figure 12 comes from a Book of Hours (containing prayers to be said at the canonical hours of the day) written the southeast of England in the mid-fifteenth century and is the beginning of the text for the Matins of the Virgin. Instructors might use this augmentation to begin a discussion of medieval manuscript production and book arts, paleography, or late medieval Christianity. More importantly, the image conveys to the students a better sense of how readers of Chaucer's work might have encountered it. The goal is not a bastardization of a folio from a Book of Hours. Although we are talking about a printed page and not a computer-generated 3D model, this design choice goes back to the question: how real must the any historic visualization be? A digitized manuscript is only a facsimile of the original; no matter how well it is visually rendered, the digital version lacks the weight and texture of the real object. The pages designed for *The Augmented Palimpsest* project are not intended to replicate the original manuscript but rather re-create the poem as a new, virtualized teaching edition of the text. The

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[36] All manuscript borders come from The British Library's *Digital Catalogue of Illuminated Manuscripts*. Web. 11 Feb. 2016
http://www.bl.uk/catalogues/illuminatedmanuscripts/welcome.htm

virtual world, VR environment, and AR-enhanced text are simply lenses through which we can examine a medieval object and see it in new ways.

The argument can be made that none of these technologies offer a truly immersive experience unless all five senses of the participant are engaged. Certainly, computer technology can generate both visual and aural enhancements in the form of 3D models and recorded sound. However, touch, smell, and taste are more challenging. Haptic tools, such as gloves or a stylus device, are becoming more popular and offer both the VR and AR user the ability to touch and sense physical contact with virtual objects. Demand has been less so far for smell and taste, although there have been some experiments, largely unsuccessful, in adding odors to virtual worlds. If full sensory engagement is required for a virtual world to be completely realized, then perhaps the most immersive and interactive experience of the Middle Ages may be one that is not computer-generated at all: Jorvik Viking Centre <http://jorvik-viking-centre.co.uk/>. Located in York, England, the museum and tourist attraction was created in 1984 and has long been famous for its appeal to the senses of its visitors, most significantly the sense of smell. A quick glance at such online review sites as Trip Advisor, Virtualtourist,com, etc. makes is clear that the intentional smells associate with the exhibit are not just memorable but also a significant factor in recommending the Jorvik Viking Centre. The exhibit's use of scents to enhance the Viking experience has even generated scholarship exploring the effectiveness of odor in retrieving the memory of the tourist experience. Apparently, it is very effective.[37] The Centre, in

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[37] See J.P. Aggleton and L. Waskett, "The Ability of Odors to Serve as State-Dependent Cues for Real-World Memories: Can Viking Smells Aid the Recall of Viking Experiences?" *British Journal of Psychology* 90 (1999): 1-7; capitalizing on the Centre success with odor and its notoriety, York's tourism board published Britain's first scented tourist guidebook in 2014 [Sarah Gordon, "The scratch 'n sniff tourist guide! York issues the UK's FIRST scented guidebook to tempt the noses of tourists," *DailyMail.com*, 7 Mar, 2014, Web, 15 May 2016

fact, intentionally engages all the senses of its visitors in order to make the historic re-creation a memorable and educational experience. It promotes its non-digital exhibit in the language of virtual and augmented technologies, inviting guests to have a 4D Viking encounter rather than a mere 3D one. And the website emphasizes that *all* five senses of its visitors will be fully engaged:

> **Touch:** Handling collection of Viking Age artefacts, including bone, antler and pottery, on offer to visitors in the queue – participants will be blindfolded and asked to identify the object/material.
>
> **Sight:** Binoculars are available in the 'Time Capsules' that take visitors around the re-created Viking city. These are to be used to spot the various animals that inhabit the scenes of the ride experience. A "spotter's guide" will be issued, allowing visitors to score themselves against their finds.
>
> **Taste:** A Viking Host will be on hand to explain the Viking diet and offer up tasters of unsalted, dried cod (a Norse delicacy) and for visitors over 18, Mead, a beverage made of fermented honey, will be available.
>
> **Smell:** JORVIK is already famed for its re-creation of the smells of the 10th century York but this will be taken a step further with the introduction of 'smell boxes' in the 'Artefacts Alive' gallery. A new aroma will be located next to a display of object, with the smell paired to match the contents. 4 smells will be available: Iron (for the Iron working display), Leather (next to the leather and shoemaking) Beef (for the general living display) and wood (for our wood finds).

> **Sound:** A Viking will entertain visitors with period-specific musical instruments (including a recreation of the panpipes found at Coppergate) and re-tellings of some favourite Viking sagas.[38]

As we move forward with these technologies, we must give serious consideration to the goals we need and/or wish them to meet. At this point in time, VR and AR are very successful in engaging audiences for pedagogical and entertainment purposes:

> The increasing development of VR technologies, interfaces, interaction techniques and devices has greatly improved the efficacy and usability of VR, providing more natural and obvious modes of interaction and motivational elements. This has helped institutions of informal education, such as museums, media research, and cultural centers to embrace virtual technologies and support their transition from the research laboratory to the public realm.[39]

Whether the user is visiting a virtual heritage site or reading an AR-enhanced text, the experience can be highly engaging and educational as long as expert guidance is provided. Virtual worlds cannot substitute for pedagogical instruction. It is not so much that the user must be reminded that the virtualization is not real; rather, supporting documentation must be easily accessible within the virtual world to help the participant understand the meaning and significance of the 3D models he or she encounters. And content builders must take an interdisciplinary, if not transdisciplinary, approach to the creation of the 3D models and their virtual or augmented worlds if the learning experience of the participant is to be as significant and valuable.

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[38] Jorvik Viking Centre, "Forget 3D—Discover Vikings in 4D this Summer,"*Jorvik Viking Centre*, 2016, Web, 15 Feb. 2016, http://jorvik-viking-centre.co.uk/contact-us/press/forget-3d-discover-vikings-in-4d-this-summer/
[39] Rousso, 93.

What is less clear is how these technologies can fulfill research objectives. As scholars and experts, we require the 3D models and their environments to be historically accurate. But must they be an exact replica of the original? No, they do not. As Willard McCarty has noted,

> The best model [e.g., digital humanities tool] of something, that is, comes as close as possible to what we think we know about the thing in question yet fails to duplicate perfectly that knowledge. Failure of the model in an engineering sense is its success as an epistemological instrument of research, because skillfully engineered failure shows us where we are ignorant.[40]

Failing to create the perfect 3D model of an object in terms of historical authenticity is to be expected and appreciated for what it can teach us not just about the technology but about the 3D model itself in terms of our understanding of its historic accuracy. Even as teaching tools, VR and AR force the medieval experts, as content creators, to think very carefully and intentionally about the re-creation. To be frank, precise verisimilitude could only be achieved by travelling back in time to the Middle Ages to conduct the kind of fieldwork envisioned by Connie Willis in her 1992 science fiction novel *The Doomsday Book*: an unlikely prospect by anyone's standards.[41] However, it is important that we think beyond what virtualization, VR, and AR can do today. Even if we fail to achieve what we want the technology to do, we will only learn from our mistakes.

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[40] Willard McCarty, "Humanities Computing," *Encyclopedia of Library and Information Science* (New York: Marcel Dekker, 2003), 1232.

[41] Curiously, in 1935, a version of what we consider to be VR glasses was, in fact, envisioned by science fiction writer Stanley Grauman Weinbaum in his short story "Pygmalion's Spectacles;" see *Project Gutenberg* http://www.gutenberg.org/files/22893/22893-h/22893-h.htm

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Augmenting Chaucer: Augmented Reality and Medieval Texts

The "*Troilus* Frontispiece" (Corpus Christi College, Cambridge as MS. 61) depicts for many the quintessential version of medieval textuality (see Figure 1). In this image, Chaucer, standing at a lectern, appears to be declaiming his story of Troy to an aristocratic audience while in a frame above the story of Troy itself is depicted. The audience, rather than passively listening to the story, appear to be talking, perhaps discussing the story as they hear it unfold. As Mary Carruthers has recently asserted, this image suggests that text in late medieval England could be an oral and social event — performance— rather than a physical object, arguing that "in 1420, despite many, many books being written, owned with pride, and circulated widely, social textuality, marked always as an oral performance, was still valued above acts of solitary composition, material writing, and silent reading, all of which activities were also very common from antiquity on."[42] How were medieval texts experienced? Were they read silently? read aloud alone? read to an audience? Most likely all three. So in their time they were "remediated" in ways that we don't consider with modern texts. Despite the ubiquity of multi-media productions, today's readers conceive of text as something read in quiet solitude. It is placed in contrast to the noisier medium of television, and the hypermedia environment of the Internet. They view

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[42] Mary Carruthers, "The Sociable Text of the'Troilus Frontispiece": A Different Mode of Textuality," *ELH* 81 (2014), 428.

reading as contemplative, a turning back to a less hectic version of life, an older time. Yet this understanding of the nature and history of texts and of reading as something quiet and solitary, while not a new concept, is nevertheless a norm of reading established well after the medieval period.[43] Modern remediations of medieval texts, such as digital editions, are placed in contrast to this primary medium, the print text, and each medium has its defenders and detractors.[44] Yet the *print* text itself was a remediation of the medieval manuscript and offers different affordances and possesses different constraints. It seems more fruitful then, to consider these new remediations of medieval texts in terms of their own affordances — what is it that these new versions of medieval works offer to their readers and what are their limitations? To the more usual consideration of print texts versus digital texts, we would like to offer a third medium, the augmented reality (AR) text which blends elements of both and offers readers yet another new reading experience.

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[43] Carruthers argues that the shift from valuing orality to valuing the written text happened gradually over time, with the written text solidifying its dominance with the advent of bulk printing. 427-8.

[44] Jay Bolter and Richard Grusin define "remediation" as the representing of one medium by another medium. In this case, it would mean early print versions of medieval texts. See See Jay Bolter and Richard Grusin, *Remediation: Understanding New Media*, (Cambridge, MA: MIT Press, 1999) 45.

Figure 1: Corpus Christi College, Cambridge as MS. 61 [45]

With the advent of the printing press, the nature of textual transmission changed

dramatically, and this change in transmission method had implications not only for the type of

text that was being transmitted but also for the readers' understanding of that text. The

experience of "reading" a medieval manuscript was very different from that of "reading" a

printed text. Manuscripts were unique productions, each with its variations in text, scribal hand,

illuminations, and marginal commentary. Even manuscripts copied by the same scribe from the

same text would likely vary. The manuscripts varied based on several factors: for whom were

they being made? Were they presentation copies with elaborate illuminations, or were they for a

less affluent reader? Which version of the author's text was being copied? How alert or careful

was the scribe? And even, what did the scribe think of the work that he was copying? The threat

> **Commented [andrea ha1]:** Could add images here of manuscripts as illustration to the electronic part of the text.

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[45] Image made available through Parker Library on the Web (Corpus Christi College and Stanford University) https://parkerweb.stanford.edu/parker/actions/thumbnail_view.do?size=basic&ms_no=61&page=1V

of scribal incompetence was famously expressed by Chaucer in his poem "Chaucers Wordes unto Adam, His Owne Scriveyn"

> Adam scriveyn, if ever it thee bifalle,
>
> Boece or Troylus for to wryten newe,
>
> Under thy long lokkes thou most have the scalle,
>
> But after my makyng thow wryte more trewe;
>
> So ofte adaye I mot thy werk renewe,
>
> It to correcte and eke to rubbe and scrape,
>
> And al is thorugh thy negligence and rape. (Lines 1-7)

Here Chaucer curses the incompetent scribe, Adam, with the "scalle," a scabby disease of the scalp that causes Adam to scrape his scalp as the author must scrape the parchment to remove the erroneously copied text.

The manuscripts representing Chaucer's text *The Canterbury Tales* demonstrate this diversity in text and form. The tale survives in eighty-two manuscripts in partial form and in only two complete manuscripts: the Ellesmere manuscript and the Hengwrt manuscript. None of these manuscripts appear to date from Chaucer's lifetime, and they contain variations both in text and in the order of the tales. The two primary manuscripts also differ in the degree of illumination. The Ellesmere manuscript is more richly decorated than is the Hengwrt manuscript.[46] The

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[46] The Ellesmere Manuscript, EL 26 C 9, is available online at Huntington Library, San Marino, California.

Commented [andrea ha2]: On-line — images of the two manuscripts.

popularity of the work meant that the text was frequently copied, with and without authorial permission, and these copies were subject to both inadvertent scribal error and deliberate scribal emendation. One medieval reader of *The Canterbury Tales* was not likely, then, to read precisely the same work as the next.

Perhaps more important to the "reader's" experience of the text were the reading conventions of the time. As Mary Carruthers suggests in her analysis of the *"Troilus Frontispiece,"* our understanding of orality and literacy should not be limited to the technology of production (oral text, manuscript, or print codex), but rather should consider the social function, and reception of the text, as well. While silent private reading was not unheard of in the medieval period, texts were also commonly read aloud both privately (the solitary reader) and as a social performance. In the frontispiece, the audience appears to be talking amongst themselves as they attend to the story of Troy. Carruthers argues that this behaviour, seen perhaps as rude today, would have been more typical of the late medieval audience: "Medieval audiences are not thought of as passive receptacles, nor as solitary exegetes, but as judges. . . In the "*Troilus* Frontispiece," the Author figure is not the historical human being, but rather it represents *the poem* directly telling us its stories *now,* as we listen, comment, and engage with them."[47] Like a verbal expression of marginal commentary, this interactive social reading practice represents a mode of engagement with the text that seems odd to modern readers, and perhaps an impediment

http://hdl.huntington.org/cdm/ref/collection/p15150coll7/id/2838 (accessed 6/15/2016). The Hengwrt manuscript, Peniarth MS 392D, is available online at The National Library of Wales https://www.llgc.org.uk/?id=257 (accessed 6/15/2016).

[47] Carruthers, 434-5.

to understanding. It bears, however, some resemblance to the teaching method of physics professor Eric Mazur as described in a recent article in the *Chronicle of Higher Education.* Mazur, frustrated with the difficulty that his students seemed to encounter trying to understand concepts based on lecture alone, began to incorporate periods of peer-to-peer discourse. "One of his standbys involves a basic concept about how molecules behave when they are heated. He explains it, then asks those in his audience to apply the idea to a new context, make a prediction, and persuade someone nearby that their answer is right."[48] In this version of the lecture, the students — like the imaginary audience of the "*Troilus* Frontispiece" — become active participants in the "text" of the lecture, creating a meaning (an understanding of the material) in conjunction with it. Just so, in the medieval period, reading of a text could be a social occasion, an oral transmission of the text.

The arrival of the printing press in about 1440 represents a remediation of the medieval text that has profound implications for the readers' experience.[49] From the multiplicity of texts represented in medieval manuscripts, subject to both authorial and scribal emendation and error, the text became one that could be consistently mass produced, thus stabilizing that text for the readership. This "stable" text itself argues for an authority — a privileged representation — of the

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[48] Dan Berrett, "The Making of a Teaching Evangelist." *The Chronicle of Higher Education*, June 05, 2016. http://chronicle.com/article/The-Making-of-a-Teaching/236706 (accessed 6/9/2016)

[49] For more on the effect of the printing press on literacy in the Early Modern Period, see Elizabeth L. Eisenstein, *The Printing Press as an Agent of Change* (Cambridge: Cambridge UP, 1980). Elizabeth L. Eisenstein, *The Printing Revolution in Early Modern Europe* (Cambridge: Cambridge UP, 2012). Marshall McLuhan, *The Gutenberg Galaxy* (Toronto: U of Toronto P, 1962). Walter J. Ong, *Orality and Literacy: the technologizing of the word* (London: Routledge, 1982). Tessa Watt, *Cheap Print and Popular Piety, 1550-1640* (Cambridge: Cambridge UP, 1991).

manuscript texts that it reproduced. In the printing of medieval text such as Chaucer's *Canterbury Tales*, whose extant manuscripts vary significantly in their ordering of the tales, and to a lesser degree in their language, the printer or editor must choose which text is going to be privileges as the authoritative text, suppressing variant texts.[50]

In this printed remediation of the medieval manuscript, the editions purport an immediacy — the idea that the edition is bringing to the reader the medieval text as presented by the author.[51] However, the experience of the text for that post-manuscript edition is markedly different in several regards from what the medieval reader would have experienced. As Jerome McGann has argued in conjunction with his *Rossetti Archive* project, it is not only the text but the context that makes meaning. In discussing the theory of textuality that informed his *Rossetti Archive* and its aim of synthesizing the critical and facsimile edition, he explains that:

> The theory holds two positions: first that the apparitions of text, — its parataxis, bibliographical codes, and all visual features— are as important in the text's signifying programs as the linguistic elements; second, that the social intercourse of texts — the *context* of their relations — must be conceived an essential part of the "text itself."[52]

With the exception of manuscript facsimile print editions, the printed text removes from the medieval manuscript many of the visual features of the text, most notably the illuminations, thus

[50] See [50] Jerome McGann, *Radiant textuality : literature after the World Wide Web*. (New York: Palgrave, 2001), 13-14.

[51] For a discussion of immediacy, see Jay Bolter and Richard Grusin, *Remediation: Understanding New Media*, (Cambridge, MA: MIT Press, 1999), Chapter 1.

[52] Jerome McGann, *Radiant textuality : literature after the World Wide Web*. (New York: Palgrave, 2001), 11-12.

materially altering the reader's experience of the text.[53] As Jay Bolter and Richard Grusin have argued, the illuminated manuscript might be seen in terms of hypermediacy:

> Like immediacy, hypermediacy has its history. A medieval illuminated manuscript, as seventeenth-century painting by David Bailly, and a buttoned and windowed multimedia application are all expression of a fascination with media. In medieval manuscripts, the large capital letters may be elaborately decorated, but they still constitute part of the text itself, and we are challenged to appreciate the integration of text and image.[54]

In moving from a text with images to a text without, the reader experiences the text in a different way. Some of this shift in early modern England was part of a deliberate shift away from the visual culture of Catholicism to the logo-centric culture of Protestantism. Patrick Collinson argues that English society in the late sixteenth century changed from "a culture of orality and image to one of print culture: from one mental and imaginative 'set' to another."[55] This shift appears to have happened gradually over the course of the early modern period, and because we are considering here the remediation of medieval texts, our focus is not on the history of early modern print per se, but rather the effect that this shift to logocentrism and print culture has had on our subsequent understanding of texts.

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[53] Early printed texts sometimes reproduced a script-like font and elaborate capitals to mimic manuscript formatting. See N.F. Blake, "From Manuscript to Print," *Book Production*. Eds. Griffiths and Pearsall. (Cambridge: Cambridge UP, 1989), 404-7. Julia Crick, Alexandra Walsham, *The Uses of Script and Print, 1300-1700*. (Cambridge: Cambridge UP, 2004), 12-18.

[54] Bolter and Grusin, 12.

[55] Patrick Collinson, *The Birthpangs of Protestant England. Religious and Cultural Change in the Sixteenth and Seventeenth Centuries*. (New York: St. Martin's P., 1988), 99.

With this gradual shift in the sixteenth and seventeenth centuries away from image in text, we also see a gradual shift away from the orality of texts. Tessa Watt argues in *Cheap Print and Popular Piety, 1550-1640* that the chapbooks and broadsides of the period were still often meant to be read aloud or sung. The audience is conceived of as both readers and hearers.[56] She also notes the importance of multi-media in the audiences understanding of early printed broadside ballads.

> The meaning of a printed ballad was not only in its text, but also in the melody of the tune it was sung to; its tempo and instrumentation; the coalition of the performance; the talent, character and social status of the singer; the people in the audience; the other songs sung before and after; even the other songs sung to the same tune, which resonated in the ears of the listener. The meaning could also be in the woodcuts along the top of the broads; its location on the alehouse or cottage wall, the other ballads or painted cloths in the room; and the stained glass windows or paintings in the local church with recurred in the mind' eye of the viewer.[57]

Over the course of the early modern period in England, the relationship between "reader" and text gradually changes from an image-rich, oral, and often social occasion for a largely elite population, to a more logo-centric, and silent occupation.[58] As the printed books became more

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[56] Tessa Watt, *Cheap Print and Popular Piety, 1550-1640*. (Cambridge: Cambridge UP, 1991), 3.

[57] Watt, 329.

[58] Watt argues that the iconic and the verbal existed "in fruitful tension" throughout the seventeenth century. Perhaps even more interesting, she comments on the increased logocentrism of the modern reader: "How can we logo-centric historians conceptualize that fragmentary,

readily available, and as literacy increased, reading appears to move more from the public to the private sphere, something that carries over to our reading practices today.

Modern students and scholars of medieval texts encounter them from a logocentrism that has been firmly established as part of reading culture from the seventeeth to the twentieth centuries, so much so, that digital editions with their hypermediacy (links to other sources, images, and video), are sometimes seen as threats to reading comprehension. These fears are perhaps not entirely without basis. Recent neurological studies have demonstrated differences in how we read and comprehend print versus digital texts. A recent Swedish study conducted by Anne Mangen, Bente R. Walgermo, and Kolbjørn Brønnick found that students' comprehension and retention of a text was higher when they read from a print text rather than an e-text.[59] Indeed the two forms of reading do seem to involve different neurological processes.[60] However, both the print (codex) form and the digital form have benefits.

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heterogeneous patchwork of images which made up 'commonplace' or 'popular' religious belief?" 331.

[59] Anne Mangen, Bente R. Walgermo, and Kolbjørn Brønnick, "Reading linear texts on paper versus computer screen: Effects on reading comprehension," *International Journal of Educational Research* 58 (2013), 61–68; for a layman's overview of the issues, see Ferris Jabr "Do e-readers inhibit reading comprehension?" *Salon*, April 14, 2013, http://www.salon.com/2013/04/14/do_e_readers_inhibit_reading_comprehension_partner/. Other studies have found little or no effect on reading comprehension, so the issue is far from settled [Caroline Connell, Lauren Bayliss, and Whitney Farmer, "Effects of eBook Readers and Tablet Computers on Reading Comprehension," *International Journal of Instructional Media* 39, no. 2, (2012), 131-140, and Annette Kujawski Taylor, "Students Learn Equally Well from Digital as from Paperbound Texts," *Teaching of Psychology* 38, no. 4 (2011), 278-81].

[60] see Maryanne Wolf, *Proust and the Squid: The Story of Science and the Reading Brain* (New York: Harper Perennial, 2008), Chapters 2 and 3.

Print texts offer to the reader a stability of form that is often missing from digital texts. This stability of form helps the reader to both comprehend the scope of the work and to recall content. When a reader approaches a print text, he/she can quickly assess the length of the text by paging through it, something that is not sufficiently conveyed by a reading progress status bar in an e-reader. Because the print page is fixed, readers can use location on the page to recall content — picturing where on the page the relevant passage was printed. With most digital texts, the pagination varies based on the size of the screen and the font size chosen by the reader. This means that readers may no longer use this "image" of the page to recall text (although with the search functionality of most e-readers, this is perhaps a small concern). Print texts also offer the reader a different kinesthetic experience. "There is a physicality to reading…" says neurologist Maryanne Wolf, "maybe even more than we want to think about as we lurch into digital reading—as we move forward perhaps with too little reflection. I would like to preserve the absolute best of older forms, but know when to use the new."[61] The weight of the book, the turning of the pages, the texture of the print page may engage our brains differently than the smooth screen of the e-reader.

Finally, the print text encourages a linear reading process. Whether this linearity is a positive or negative depends, perhaps, on the nature of the texts and the goals of the reader. Linear reading, or reading the primary text starting from the beginning and continuing through to the end with little to no deviation from it, facilitates a focusing on the text itself, the "close reading" of language long valued in the literary classroom. Katherine Hayles, in *How We Think: Digital Media and Contemporary Technogenesis,* makes the distinction between what she terms hyper reading and close reading:

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[61] Cited in Jabr.

Hyper reading, which includes skimming, scanning, fragmenting, and juxtaposing texts, is a strategic response to an information-intensive environment, aiming to conserve attention by quickly identifying relevant information, so that only relatively few portions of a given text are actually read. Hyper reading correlates, I suggest, with hyper attention, a cognitive mode that has a low threshold for boredom, alternates flexibly between different information streams, and prefers a high level of stimulation.[62]

In contrast, close reading, according to Hayles "correlates to deep attention," a cognitive mode which requires a lower level of stimulation, prefers a focus on a single stream of information or cultural artifact, and has a higher threshold for boredom.[63] Print texts, are more suited to the deep attention cognitive mode because they offer relatively few distractions from that primary information stream — the text.

To some extent, we should be aware of the values that we attach to these terms. The terms "close reading" and "deep attention" in themselves suggest a more rigorous (and thus valuable) engagement with the text than "hyper reading." The promise of engagement with the text without "distraction" also suggests an immediacy, as Bolter and Grusin would say; we perceive our interaction with the text as an engagement with the content directly without awareness of the medium. But does this valuing of the written word over other media stem from the shift to logocentrism and the turn away visual and oral media that began with the English Reformation? "Hyper reading" too has value to readers, allowing them to quickly gain an overview of a large

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[62] N. Katherine Hayles, *How we think: Digital media and contemporary technogenesis.* (Chicago: University of Chicago Press, 2012), 12.

[63] Hayles, 12.

body of information, see a range of possibilities, and quickly find passages/information relevant to their inquiry.[64]

What print texts do well is facilitate the reader's ability to maintain a focused attention on the language of the text. This focus on language becomes particularly important, perhaps, when teaching medieval texts because of the difficulty that early English presents to students. The strangeness of the language means that there can be no pretense of immediacy (a window onto the content without an awareness of the medium). The students, in struggling through the strange letters, spellings, and vocabulary of Middle English, are constantly reminded of the medium because they must engage in some level of translation in order to understand the text. Yet, as important as this focus on language is, when we consider print editions of medieval works as remediations, we should consider not only the technology (parchment vs. paper, hand-copied vs. machine printed, etc.) but also the reading practices. Mary Carruthers argues that our modern valuing of written texts skews our understandings of earlier textual traditions:

> The great debate about orality and literacy it seems to me has been limited by its near-exclusive focus on issues of technology, trading production and reception as wholly separate matters, another symptom of modern assumptions about the nature of textuality. Our default value for texts is the written, which we assume to be the state toward which all cultures and their texts aspire. So dominant is this value now that many scholars have assumed that literacy always trumps orality, despite much evidence to the contrary even in our contemporary cultures. What is true, I think, is that the relative valuation of Written over Oral has shifted. This

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[64] Hayles, 62.

value shift was only made gradually, over many centuries, and was not complete until well after the advent of bulk printing — indeed, it isn't complete in all situations even yet (teaching comes to mind). And this shift of cultural valuation — I would argue — is more significant for thinking about Text than the technological facts, important as those are.[65]

As reading culture changed from one that was more oral and more social to one that was silent and solitary, the experience of "reading" or encountering the text changed. Because our own reading practices have changed (we are trained from a young age to read silently), it is difficult to recover some of the orality of earlier texts when using print editions.

Digital editions offer a way to recapture both a better sense of the orality of earlier texts and a better understanding of the variety of medieval textual culture. With a digital text, the author might choose to provide images of the original manuscript or manuscripts; she might link to other known variants of the text, and she might include an audio file so that the reader might also be able to hear the text, rather than reading it silently. This last is particularly important to students of early English, because *hearing* the text as they read can increase understanding. Images, such as the illuminations that accompanied the text, may more economically be included, restoring some of the hypermedia elements of medieval manuscripts. The digital edition might also include historical contextualization, access to images of cultural artifacts, access to other texts from the period, audio or video files, in order to help readers to better understand the socio-historical context of literature that is foreign to them either chronologically or culturally.

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[65] Carruthers, 427-8.

Web 2.0 technologies, which allow the user to integrate their own content into the digital work, harkens back to the more interactive vision of the reading audience that the "*Troilus Frontispiece*" presents. Web 2.0 technologies encourage the "reader" of the digital text to become participatory. The reader need no longer be a passive receiver of information but rather might have the capability to comment on, add to, or even revise the text itself. This "active reader" resembles Carruther's description of medieval readers who were "not thought of as passive receptacles, not as solitary exegetes, but as judges."[66] Unfortunately, to date most e-reader editions do not include many of these functionalities but rather mimic in electronic form the print edition of the text. It is still primarily hypertext documents that best make use of the breadth of resources and multi-modal elements of the digital environment.

When digital texts move away from simple reproductions of the print text in digital form to a hypertext environment, the reader has the opportunity to become even more engaged in the creation of the text she is reading. Digital texts are more likely to be "ergodic literature" a term coined by Espen J. Arseth in his 1997 book, *Cybertext*. In his introduction, he defines ergodic literature as "a work of physical construction that the various concepts of 'reading' do not account for. This phenomenon [he calls] ergodic, using a term appropriated from physics that derives from the Greek words ergon and hodos, meaning 'work' and 'path.' In ergodic literature, nontrivial effort is required to allow the reader to traverse the text."[67] The reader of ergodic

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[66] Carruthers, 434-5. She quotes Alan of Little in the preface to *Anticlaudianus*: "Let the reader. . . improving the work with the file of correction. . ., prune what is too overgrown and fill out what is too brief, so that whatever is rough may be returned to the file, the unpolished revert to the workshop, the inelegant return to the artist, the poorly turned to be made right again by hammering" (quoted in Carruthers 435).

[67] Espen J. Arseth, *Cybertext*, (Baltimore: JHU Press, 1997), 1.

literature, according to Arseth, become less passive — a user or co-creator of the finished work. In a cybertext, the reader need not read the main text from beginning to end but rather may wander on a variety of paths as the hyperlinks within the text spur his interest. A cybertext of *The Canterbury Tales* might lead the reader from a description of the pilgrims in the General Prologue, to a treatise on pilgrimage in fourteenth century England, or to an explanation of the role of Pardoners. Each of these pages might lead the reader on to more pages even farther removed from the original text. The promise that this offers is that the reader's own interest guides his/her travels through the text, and in these deviations from the primary text, the reader will be gaining greater socio-historical contextualization. The reader of an ergodic text may not return to the primary text but rather become lost in the labyrinth of cyberspace. A hypertext and its embedded links represents not one text, or reading, but many. What the author may have visualized as the path through the text and its related documents may vary significantly from the path taken by the reader. This is the "hyper-reading" of Hayles rather than "close reading." And while something is gained through this type of reading, something is lost as well. The differing qualities of the two cognitive modes means that the type of understanding the reader is gaining from the text in each of the two modes, differs greatly as well.

A third medium, the augmented reality (AR) text, blends aspects of both print and digital texts, offering yet another remediation of medieval literature. An AR text uses a printed page as a base for digital enhancements. These digital enhancements may be accessed through scanning the page with a smart device such as an iPhone or tablet. The AR text thus combines the stability of the printed text with the flexibility and hypermediacy of digital texts.

What is Augmented Reality? Augmented reality is a medium in which digital information is *overlaid* on the physical world. This digital information should be in both spatial and temporal

registration with the physical world, meaning that the participant using the AR technology experiences the digital content in real time, and in the space they are physically occupying.[68] The participant should be able to interact with the digital content just as they would be able to interact with items in the physical world. Alan Craig gives the following example:

> Imagine for a moment that you go to visit a vacant lot where you intend to build your dream home. Now let's consider an augmented reality experience in which you go to that (vacant) lot, but through the use of technology you are able to see your dream home in place on that lot. You can walk around the house and see it from all different viewpoints just like you could if the house was actually completed on the lot. You can interact with the house, open the door, and so on just like you could in the real world.[69] In other words, AR applications combine the real and the virtual for the user.

An augmented reality text is a printed text that triggers an overlay of digital information. Recent examples of augmented reality texts include coloring books (such as Quiver),[70] that allow children to color images and then see those images (colored by the child) emerge in three dimensions from the page. Many of these 3D images may then be interacted with in some fashion, such as rockets that may be lit to produce fireworks, or a fire truck that can zoom off of the page. AR texts have also emerged as a marketing tool. The 2013 Ikea catalog, for example, used AR technology to allow customers to preview furniture in their own home through the use

Commented [andrea ha3]: We could add image of this to electronic version

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[68] Alan B. Craig, *Understanding Augmented Reality* (Waltham, MA: Elsevier, 2013), 36.

[69] Alan B. Craig, Understanding Augmented Reality (Waltham, MA: Elsevier, 2013), 2.

[70] Quiver. quivervision.com accessed 6/13/2016

of a smart device and an Ikea application. The customer could scan the relevant part of the catalog and place the item into their own home.

These pieces could be viewed in three dimensions, from multiple angles, could be walked around, or moved to another part of the home.

AR texts are not new. Mark Billinghurst and his team at the Human Interface Technology (HIT) Lab, University of Canterbury, New Zealand, created some of the first examples in the early 2000s. Called "magicbooks," the texts are designed to encourage children to read:

> The computer interface has become invisible and the user can interact with
> graphical content as easily as reading a book. This is because the MagicBook
> interface metaphors are consistent with the form of the physical objects used.
> Turning a book page to change virtual scenes is as natural as rotating the page to
> see a different side of the virtual models. Holding up the AR display to the face to
> see an enhanced view is similar to using reading glasses or a magnifying lens.

Rather than using a mouse and keyboard based interface users manipulate virtual models using real physical objects and natural motions. Although the graphical content is not real, it looks and behaves like a real object, increasing ease of use.[71]

How, then, might this new medium be used in the teaching of medieval texts?

The experience of reading a medieval text goes beyond the apprehension of the "story" or "language" of the work. Each reading of the work depends on the reader's own background in and familiarity with medieval history and culture, and his/her skill level with the language of the text. It will be influenced by the reader's previous reading experience, as well as by the form that the text takes (digital vs. print/plain text vs. illuminated, etc.), and it will be influenced by *how* the reader reads or experiences the text, silently? aloud? Both AR texts and digital texts can reintroduce to the modern reader some of the elements of medieval manuscript/reading culture that were lost with the transition to print: the multiplicity of variant texts, the illuminations in the manuscripts, and the sound of the text being read. Because they are less limited by the cost of printing, they can more easily provide social and historical contextualization for the student of medieval literature, providing not only descriptions, but also images of medieval society and material culture. The augmented reality text, because it exists as a physical print text, retains some of the stability of the print text as well. When used in an educational environment, this stability of text can allow the instructor to either focus the students' attention on the language of the text itself (deep reading), or lead them to the digital resources that will enhance their understanding of the text.

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[71] Mark Billinghurst, Hirokazu Kato, and Ivan Poupyrev, "The MagicBook: A Transitional AR Interface," *Computers & Graphics* 25.5 (2001), 747.

Our project, *The Augmented Palimpsest*, serves as one such remediation of a medieval text.[72] The question that we set out to examine was how the medium of AR can be applied to teach medieval literature effectively? Most American students have had little to no introduction to the medieval period and its texts. Furthermore, their impressions of the period are formed primarily through fantasy media. Our students, unlike their European counterparts, cannot easily visit a medieval cathedral, castle, or home. Nor do our universities have access to medieval manuscripts or other examples of material culture. Both the language, and the culture are foreign to our students. So, our immediate goal has been to make the reading and comprehension of medieval literary texts easier for our students and to give them a greater understanding not only of the texts themselves but also of the culture that produced the texts. However, our long-term objectives are much broader. We intend to study how the use of AR texts affect student comprehension of difficult texts. In other words, how might this sort of text make a work that is alien to the reader — distanced temporally or culturally — more comprehensible to them? How might the multi-media nature of the text affect learning more generally? And lastly, how might this AR print medium function differently in the classroom as compared to either traditional print texts or digital texts?

The project uses the "General Prologue" to Geoffrey Chaucer's *The Canterbury Tales* as the literary text the students will read. We are creating simple print pages with highly detailed borders taken from medieval manuscripts[73] set around the text of Chaucer's poem. The images in these detailed borders may then be scanned by our application on a smart device (such as an iPhone or iPad) to access relevant digital material. These digital enhancements include audio,

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[72] https://augmentedpalimpsest.wordpress.com/
[73] All manuscript images are provided by The British Library Catalogue of Illuminated Manuscripts, http://www.bl.uk/catalogues/illuminatedmanuscripts/welcome.htm

video, and graphical materials; and 3D models of figures, architecture and objects, among others. The digital enhancements provide the reader with linguistic, historical, and cultural contexts, thus giving students greater access to medieval material culture and history. The content includes 3D models of medieval artifacts (such as Canterbury Cathedral), large and complex enough to be viewed from multiple angles and function interactively with the reader. Because the enhancements emerge from the printed page, the tool improves the reader's comprehension of the text by preserving the physical and kinesthetic connection to the text while providing an immersive reading experience.

Like the hypertext, the AR text provides the reader with the ability to move away from the primary text to supplementary multi-modal material. Yet the experience of that move differs dramatically. The enhancements themselves are embedded in the design of the print page itself, and the reader must access them through scanning the print page with a smart device. So the anticipatory element of the text remains — there is the expectation that this text may lead to other texts or artifacts — but the opportunity to access the related text or artifact is delayed because it demands a more conscious decision to access the smart device and scan the trigger. This means that the act is more deliberate -- the reader must make more of a conscious choice to leave the current text to find the new artifact.

Figure 3: Sample page from the Augmented Palimpsest Project

Our Augmented Reality text incorporates many of the advantages of both the traditional print text and the digital edition. The above sample page demonstrates some of the types of enhancements that we will be using to help students with their understanding of the General Prologue. The Prologue describes a total of twenty-nine pilgrims plus the host at the Tabard Inn where the story begins. Some of these, like the priests who accompany the Prioress, receive only brief mention, but many of the characters are described in great detail; their portraits illuminating their personalities and commenting upon them. The occupations of many of these pilgrims are

obscure to modern students. They might have a vague idea of what a prioress or monk was, but no real knowledge of that role or how a person with that occupation might be expected to behave. Because of this, we chose to give each major pilgrim his or her own page in our edition so that we could include augmentations that would introduce the students to each class and its socio-historical role within the society.

In the center of the sample page above (Figure 3), we have created a text area into which we have placed the first thirty-four lines of the General Prologue in Middle English. In the left-hand column, we have placed a line-by-line glossary to help students translate some of the more difficult words in the passage. For the purposes of this sample, we have used the Project Gutenberg[74] text and gloss because they have made the edition available copyright free. [75] The medieval manuscript border comes from the British Library[76], Harley manuscript 2887, folio 29, *Book of Hours, Use of Sarum ('The Hours of the Earls of Ormond)*. We chose this image for a number of reasons: firstly, and most importantly, this border is complex enough that portions of it may be used as "fiducials," or triggers, for the augmentation. Secondly, the manuscript itself is a beautiful example of medieval book arts, providing the students with some idea of what a medieval manuscript might look like, and thirdly, the British Library has kindly made this manuscript (and many others) available copyright free and thus available to us for use in the project itself.

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[74] Project Gutenberg, http://www.gutenberg.org/cache/epub/2383/pg2383-images.html. electronic

[75] For our completed project we will be using a new edition edited by Barbara Bordelejo.

[76] British Library Catalogue of Illuminated Manuscripts, http://www.bl.uk/catalogues/illuminatedmanuscripts/ILLUMIN.ASP?Size=mid&IllID=56079

Used without accessing the digital material, the reader may focus on the primary text of the poem, just as s/he would with a traditional print text. This sustained focus on the primary text, the linear reading of it, can work to foster the deep attention needed for close reading. In a classroom setting, the instructor can more easily focus the student's attention on the primary work rather than the secondary material. Yet the supplemental material that might deepen the reader's understanding may be quickly accessed when desired.

Within the border itself, we have identified areas that might make suitable "triggers" for augmentations and created bounding boxes and labels to indicate what augmentation might be found there. When the application scans the manuscript trigger area, the smart device pulls the original manuscript image as an overlay upon the print page, for example, the original page for the sample above looks like this:

Figure 4: Harley manuscript 2887, folio 29, *Book of Hours, Use of Sarum ('The Hours of the Earls of Ormond)*

This page, from a Book of Hours (containing prayers to be said at the canonical hours of the day), is from the southeast of England in the mid fifteenth century, and begins the text for the Matins of the Virgin. Instructors might use this to begin a discussion of medieval manuscript production and book arts, paleography, or late medieval Christianity. The AR environment allows

for multiple overlays of manuscript images, so students could view first our printed composite page of the Book of Hours and the text of the "General Prologue," overlay that with an image of the original page from the Book of Hours, and over that lay an image with the relevant passage from the Ellesmere or Hengwrt manuscripts.[77] None of the borders are from manuscripts of *The Canterbury Tales*. One reason for this switch is the fact that the real borders that surround the folia of the poem in the two most important manuscripts, the Hengwrt manuscript and the Ellesmere manuscript, are not sufficiently complex or varied to serve as triggers for the digital enhancements. Another reason is to provide students with more exposure to medieval manuscripts as material culture. Each border chosen to surround that printed page of the AR-enhanced text comes from a manuscript and/or depicts images in the border that relate to the passage of the poem on the page.[78] The goal is not a bastardization of a folio from a Book of Hours. The pages designed for *The Augmented Palimpsest Project* are not intended to replicate the original manuscript but rather re-create the poem as a new, virtualized teaching edition of the text. Our AR-enhanced text is simply a lens through which we can examine a medieval work and see it in new ways.

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[77] In an ideal world, we would use one of the *Canterbury Tales* manuscripts, but that was not feasible for a couple of reasons. Chaucer's poem survives complete in two important manuscripts, the Hengwrt manuscript and the Ellesmere manuscript. While both of these manuscripts are illuminated, the illuminations are not complex enough to serve as triggers for the augmentations.

We will, however, provide links to the images of the Ellesmere manuscript made available through the Huntington Library and the Digital Scriptorium, so that students may also see the poem in its manuscript form. □Huntington Catalog Images, Digital Scriptorium Database. http://dpg.lib.berkeley.edu/webdb/dsheh/heh_brf?CallNumber=El+26+C+9

[78] All manuscript borders come from The British Library's *Digital Catalogue of Illuminated Manuscripts*. Web. 11 Feb. 2016
http://www.bl.uk/catalogues/illuminatedmanuscripts/welcome.htm

The audio file allows the readers to hear the passage read in Middle English as they follow along with the print text, a multimodal process that facilitates comprehension. Richard E Mayer and Roxana Moreno, in their 2003 study of multimedia learning, argue that multimedia learning is most effective when the information is presented in different modalities that are spatially and temporally contiguous.[79] In this case, the visual of the text of the poem is augmented by the audio of the passage being read in Middle English. Hearing Middle English spoken, as they follow along in the text, helps the students to understand this difficult variety of English. Furthermore, because reading in the Middle Ages was not a silent activity, as has been discussed above, the pairing of audio and text more closely corresponds to what the medieval experience might have been like. Other augmentations, such as the links to translation and glossary, or to an article on pilgrimage, are similar to the types of enhancements that might be found in a digital edition of the poem.

Augmented reality, however, offers a resource that is not available in either a digital or print text: 3D models that appear to emerge from the page when viewed through the smart device. These models may be walked around and viewed from multiple angles, and some may be interacted with. They may be static models, for example a 3D representation of Canterbury Cathedral; models that may be manipulated, for example the same model of the cathedral, but one that the user can remove the roof from to view the inside; or animated 3D models, for example, a knight moving through a series of poses. These 3D artifacts greatly change the user's experience with the digital environment. Unlike a 3D model in a 2D environment, an AR 3D object brings the object into the physical space occupied by the user.

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[79] Richard E. Mayer and Roxana Moreno, "Nine Ways to Reduce Cognitive Load in Multimedia Learning," *Educational Psychologist*, *38*.1 (2003), 43–52.

Figure 5: Manuscript detail from British Library Harley MS 2887, f. 29r

This particular image from the sample page triggers a 3D model of Canterbury Cathedral (see Figure 5). The user can remove the roof and explore inside simply by holding the smart device over the peacock and covering the bird's tail with the user's fingers, creating a virtual "button" on the printed page.
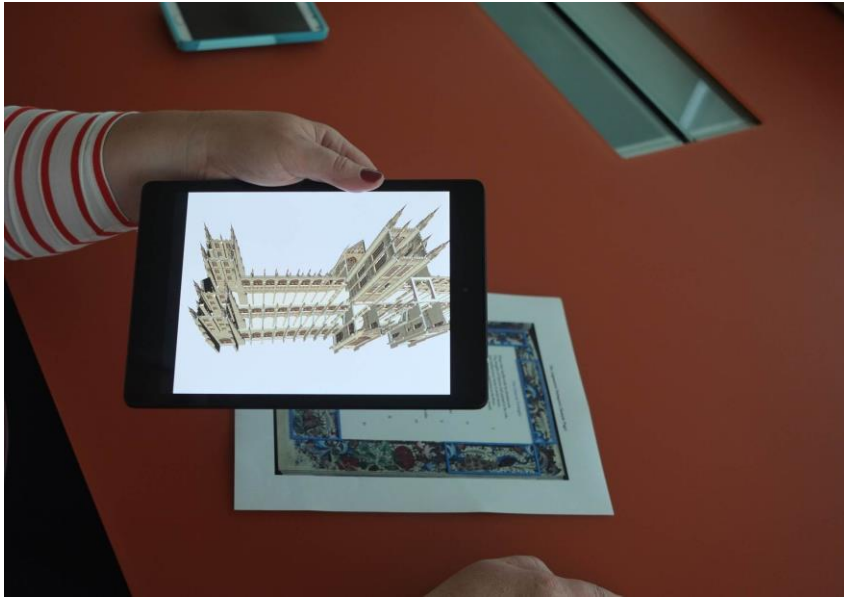
Figure 6: 3D Canterbury Cathedral (photo courtesy of Steven Weiss)

AR can bring medieval material culture to students in a new way. With AR technology, the objects can appear in three dimensions and to scale so that students can get a better sense of the object than they can through a photograph alone. This process however, does raise some questions about historical accuracy. Johanna Drucker warns against the rhetorical power of data visualizations, saying that they "perform such a powerful reification of information that graphics such as Google Maps are taken to be simply a presentation of 'what is,' as if all critical thought had been precipitously and completely jettisoned."[80]

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[80] Johanna Drucker, "Humanistic Theory and Digital Scholarship," *Debates in the Digital Humanities*, ed. Matthew Gold. loc. 2372)

Figure 7 :Bollock Dagger (Ryan W. Rocha, digital artist)

Figure 8: Testicular purse (Ryan W. Rocha, digital artist)

Virtual constructions of historical objects and architecture raise similar concerns. To what extent are these 3D models accurate representations of the original? In some ways, figures such as these serve to validate Jean Baudrillard's understanding of simulacra and concerns about the hyperreal. In *Simulacra and Simulation*, Baudrillard argues that there are three orders of simulacra: the first, associated with the early modern period, in which the image is clearly a counterfeit of the real; the second, associated with the industrial age, in which the real is so closely represented by the image that it threatens to replace the real; and the third, associated with our postmodern period, in which the image precedes the real and thus determines it.[81] This loss of distinction between reality and its representation in the third order of simulacrum results in the hyperreal—a world "without origin or reality."[82] It is pure simulation and, as a result, creates an anxiety of origin and authenticity.

Augmented reality applications have only recently begun to appear in the educational environment, so study of its educational benefits is still in its infancy. Radu notes a number of potential benefits to AR in the classroom, including "enhanced entertainment through whole body interaction, advancing education through in situ interactive visualizations, and improving rehabilitation and skill development through physical manipulation."[83] The extent of these benefits appears to depend both on the subject matter and on the type of AR experience. AR applications that rely, as ours currently does, on smart devices limit gestural interaction with the augmentations, whereas headset systems, such as Google Glass allow for much greater gestural

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[81] Jean Baudrillard, *Simulacra and Simulation*, trans. Sheila Faria Glaser (Ann Arbor: University of Michigan Press, 1994), 1-7.

[82] Baudrillard, 1.

[83] Iulian Radu, "Augmented reality in education: a meta-review and cross-media analysis." *Personal and Ubiquitous Computing,* **18**:6, (2014), 1534.

interaction. Our hope is that our AR enhancements will give our students a greater understanding of the material culture of the Middle Ages which in turn will lead to a better understanding of Chaucer's work. These virtual reconstructions of medieval artifacts are surely less valuable to students than an interaction with the real historical objects would be. However, for those students who have no recourse to the artifacts themselves, these digital recreations offer some sense of the material culture of the late medieval period. Students will gain no long term understanding of the historical and cultural contexts in relation to Chaucer's poem if the 3D models are not accurate and meaningful. Rather than a stylized dagger and bag, Figures 7 and 8 depict the bollocks dagger and testicular purse that the Pardoner could easily have brought on the pilgrimage to Canterbury Cathedral. Both 3D models are historically faithful.

Augmented reality texts can remediate medieval literature in a way that shows some pedagogical promise. As with all remediations something is gained and something is lost. But in considering the relative values of the media that bring medieval literature to us today, we should not consider which medium is "best," but rather which medium fulfills the aims or needs of the "reader." None of these media can completely recreate for the modern reader the medieval experience. Digital images of medieval manuscripts give a visual representation of the medieval text in a way that the printed version cannot, but they do not offer the physical experience of holding the page, feeling the heft of the manuscript. Digital editions can bring to the reader sounds, images, videos, and web pages that can better inform their understanding of the text, but this same hypermediacy lends itself to hyper-reading rather than deep reading, and like the digital manuscripts, lacks the physicality of reading the printed page. The augmented reality text offers, perhaps, a middle road. It allows for both the sustained attention that print texts facilitate, while at the same time providing easy access to the digital enhancements that can enrich student

understanding. With its 3D visualizations an AR text can bring, if only for a moment, a bit of medieval history or culture into American classrooms.